Moreover, the intensity level of daily PA seems to be a strong indicator of disability in obese individuals with knee OA. Therefore, our pilot study suggests that the WOMAC should be used after one or more of the recommended functional performance tests such as walking, going up and down stairs, or from sitting to standing in order to obtain a more realistic self-reported disability score. It is also suggested that progressively increasing the intensity of PA in obese individuals may decrease their disability.

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IN ORDER TO EXPLAIN KNEE PAIN DUE TO OSTEOARTHRITIS, SHOULD WE START LOOKING FOR ANSWERS OUTSIDE OF THE KNEE JOINT?

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Purpose: To explain the variance in knee pain and perceived need for surgery (PNS) using psychological measurements of depression, anxiety and stress symptoms, physical activity, Body Mass Index (BMI) and Waist Circumference (WC) in obese and non-obese individuals with knee osteoarthritis (OA).
Methods: Participants were a sample of 31 women and men between 50 and 80 years old diagnosed with knee OA, based upon radiographic examination evaluated by an orthopedic surgeon, were pre-selected. Three different methods of radiographic examination (Kellgren and Lawrence, Ahlback and Cooke) were used to detect differences between groups. Depression was assessed using the Beck Depression Inventory (BDI). The BDI is a 21-item self-report instrument intended to assess the existence and severity of symptoms of depression. Depression, Anxiety and Stress Scale (DASS) was also used. The DASS is a 42-item self-report questionnaire divided in three scales designed to measure the negative emotional states of depression, anxiety and stress. Physical Activity (PA) was assessed using Metabolic Equivalents (METs) values of common physical activities classified as light, moderate and vigorous intensity activity based on guidelines for exercise testing and prescription of the American College of Sports Medicine (ACSM). Knee pain and PNS were assessed using a visual analog scale (VAS) after performance testes, such as 6 Minute Walk Test, Timed Up and Go, stairs climbing test and peak of oxygen consumption, had been performed. Participants were asked to score by pointing on a 10 cm line (0–10) their perceived level of knee pain. Likewise for PNS, participants were asked to indicate under the same scale their perceived need for surgery.
Results: Participants were divided according to their BMI into two groups: obese and morbid obese individuals (BMI = 30 kg/m^2; $\geq$ 35 kg/m2) or group A ($N = 15$) and healthy weight and overweight individuals (BMI = 18.5–24.9 kg/m^2; BMI = 25–29.9 kg/m^2) or group B ($N = 16$). An independent *t*-test between groups did not show any significant difference in radiographic OA, indicating that both groups had similar levels of knee OA severity. Our two correlation analysis between knee pain and radiographic OA and between PNS and radiographic OA did not show any significant correlation. Multiple Regression Analysis, from a sample of 31individuals, indicated that BDI had the highest correlation with PNS ($r = .71$; $p < .0001$) and the coefficient of determination (R2) of the model was R2 = .62 ($p < .0001$). Our second Multiple Regression Analysis used a sample of 46 individuals including group A ($N = 15$), group B ($N = 16$) and healthy controls ($N = 15$). While excessive weight measured by BMI and Waist Circumference showed strong and significant correlations ($r = .64$; $p < .0001$) and ($r = .69$; $p < .0001$) with knee pain, our results indicated again that BDI had the highest correlation with knee pain ($r = .77$; $p < .0001$) and the coefficient of determination of the model was R2 = .75 ($p < .0001$).
Conclusion: Notwithstanding the importance of radiographic findings to diagnose knee OA, our study did not show any significant correlation between radiographic OA and knee pain and PNS. Knee pain, due to OA, is the predominant symptom of OA and is the general reason why people decide to undergo total knee replacement surgery. Our study emphasizes the relevance of a more comprehensive understanding of pain complaints to improve our ability to identify individuals with knee OA and to apply rational treatment strategies, thereby offering a relevant target for intervention.

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THE IMPACT OF GASTRIC BYPASS SURGERY COMPARED TO TOTAL KNEE ARTHROPLASTY FOR OSTEOARTHRITIS ON KNEE SYMPTOMS

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Purpose: Marked associations have been reported between elevated body mass index (BMI) and symptomatic knee osteoarthritis (OA). While total knee arthroplasty (TKA) provides reliable symptomatic improvement in a majority of patients with end-stage OA, physicians are frequently consulted concerning patients with knee pain who lack intra-articular pathology amenable to surgical intervention. Bariatric surgery has been demonstrated to provide significant reduction in BMI in appropriately selected individuals, although there is limited evidence concerning the impact of this procedure on knee symptoms. The purpose of the present study was to assess the impact of bariatric surgery on patient-reported knee symptoms, and to compare findings to changes in a matched group of patients who underwent TKA for OA.
Methods: Patients who underwent laparoscopic roux-en-y gastric bypass surgery (LRYGB) at a single center between April and August 2011 were assessed as part of a prospective cohort study. Twenty LRYGB patients (16 women and 4 men) with a mean age of 52 years (range, 45–65 years) and mean pre-operative BMI of 45.6 kg/m^2 (range, 34.6–64.3 kg/m^2) were included. Forty patients who underwent TKA for symptomatic OA at the same center were selected, matched 2 to 1 by age ($\pm$5 years), gender (exact), and BMI ($\pm$2). The mean age was 56 years (range, 45–67 years) and the mean pre-operative BMI was 44.6 kg/m^2 (range, 34.1–64.9) ($p = 0.495$ for difference between cohorts). In both groups, knee symptoms were assessed pre-operatively, as well as at 6 months and 1 year following surgery, using the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index pain and physical function scales. Six month and 1 year absolute and percentage change scores were evaluated and compared. Clinical outcomes for the LRYGB cohort were further stratified by presence ($n = 10$) or absence ($n = 10$) of self-reported OA.
Results: Bariatric surgery patients reported significant improvements in knee pain (mean score: 7.0 vs. 2.3 points; $p < 0.001$) and physical function (mean score: 21.4 vs. 7.1 points; $p < 0.001$) from pre-surgery to 1 year post-surgery. Compared to patients who underwent TKA, the mean percentage improvement in pain scores was similar between the two groups at both 6 month (50% LRYGB vs. 58% THA; $p = 0.387$) and 1 year follow-up (63% LRYGB vs. 68% TKA; $p = 0.493$). The LRYGB cohort experienced a significantly greater percentage improvement in physical function at 6 month follow-up (66% vs. 47% $p = 0.046$), and the difference was maintained at 1 year, though marginally non-significant (68% vs 52% $p = 0.084$). Comparatively, LRYGB patients with self-reported OA had greater knee pain and worse function pre-operatively when compared to those without OA, as well a smaller percentage improvement in pain (64% vs. 74%) and function (66% vs. 73%) scores at final follow-up.
Conclusions: Bariatric surgery provides significant improvements in patient-reported knee pain and physical function up to one year following surgery, although the effect on patient-reported outcomes was somewhat less in those who reported concurrent OA. The relative improvement in symptoms was similar to that of a matched group of patients who underwent TKA for end-stage OA. While further work is needed to better delineate the contribution of elevated BMI to knee symptoms, physicians should consider bariatric consultation for obese patients with knee symptoms lacking focal or degenerative pathology amenable to surgical management.

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CORRELATING HISTOLOGICAL CHANGES TO BEHAVIORAL CHANGES IN A RODENT MODEL OF POST-TRAUMATIC KNEE OA

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Purpose: Debilitating osteoarthritis (OA) symptoms do not always reflect radiographic indicators of joint degeneration; and, establishing a relationship between joint degeneration and symptoms in OA has been challenging to study in humans, perhaps due to the limits of assessing

joint degeneration using radiographic techniques. Histological assessment of joint damage in preclinical models can provide detailed analysis of joint changes, but assessing symptoms in animal models is a significant challenge. Recently, our group detailed changes in gait and mechanical sensitivity in a rat medial meniscus transection (MMT) model of knee OA. The purpose of this study was to examine whether histological measures of joint degeneration correlated with behavioral changes in the rat MMT model of knee OA.

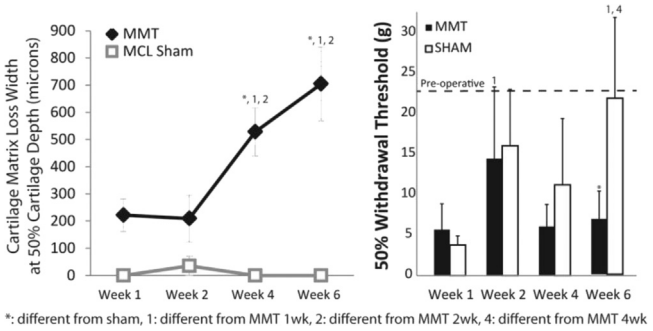
Methods: The medial collateral ligament was transected in 64 male Lewis rats (250 g) through a 1 cm skin incision along the medial aspects of the joint. 32 of the 64 animals received no additional procedures (sham surgery). In the remaining animals, the abduction moment was applied to the knee to expose the medial meniscus, and the medial meniscus was transected radially (MMT animals). An additional 8 animals received no surgical intervention (naïve control).

Ground reaction forces were collected for rats using a custom built arena (6"x72"x18") with force plates embedded in the floor (Kistler 3-component force link; ±2 kN [Fz]; ±1 kN [Fx, Fy]; 2500 Hz). Mechanical sensitivity was assessed using Chaplan's Up-Down protocol for von Frey filaments (0.6 to 26.0 g). Both behavioral tests were performed 1, 2, 4, and 6 weeks post-surgery (MMT $n = 8$, MCL sham $n = 8$ at each time point). Following behavioral testing, joints were collected, embedded in paraffin wax, section and stained with Toluidine Blue, then scored using the OARSI scheme suggested by Gerwin et al. 2010.

Differences between groups and over time were assessed via multifacto ANOVAs and post-hoc Tukey's HSD post-hoc tests. Best subset regression modeling using minimization of Mallows's Cp was used to identify histological measures with the highest correlation to a behavioral change. In addition, principal components were calculated to reduce the degree of correlations amongst histologic measures; then, the first three principal components were also correlated to behavioral changes.

Results: As expected, MMT animals developed progressive, OA-like lesions in their operated limb whereas sham animals did not exhibit significant degeneration ($p = 0.0038$, Figure 1). MMT animals remained highly sensitive at six weeks ($p < 0.001$, Figure 1) while sham animals returned to pre-operative sensitivity by six weeks ($p = 0.999$, Figure 1). Peak vertical force and vertical impulse decreased in operated limbs of MMT animals relative to their contralateral limbs ($p = 0.045$) and the operated limbs of sham animals ($p = 0.008$). Multivariate correlation analyses (which included all histological measures) did not show a significant correlation between histological measures and mechanical sensitivity ($p = 0.247$, R2 = 0.282) or dynamic gait characteristics ($p = 0.247$, R2 = 0.337). Reduction of model parameters using best subset modeling revealed significant correlations between some histological changes and behavioral changes (described in Table 1); however, the identified correlations were relatively weak (R2 < 0.3). Reduction of correlations between histological data using principal components analysis still failed to demonstrate a strong correlation between histological changes and behavioral changes (R2 < 0.3).

Conclusions: Select histological measures do have some correlation to behavioral measures in the MMT model, but histological measures account for less than a third of the variation observed amongst behavioral responses. This may be due to inconsistency in the behavioral response over time. As an example, post-surgical pain could occur at 1 week which would be reflected in behavioral analyses, but not necessarily in histopathology changes. In addition, improved measures of both behavior and histology could improve the correlation. However, it is possible that strong relationships between OA symptomology and OA pathology may not exist for tissues assessed by the OARSI histopathology scheme; and incorporating extra-articular tissues, such as muscle and neurons, may improve our understanding of the relationships between OA pathology and OA symptomology.



*: different from sham, 1: different from MMT 1wk, 2: different from MMT 2wk, 4: different from MMT 4wk

Selected Histological Measures from Best Subset Regression Modeling

Behavioral measure	Full model (Model p-value, R2)	Best subset Model (Model *p*-value, R2)	Variables included in the best subset model
Peak vertical force	0.117, 0.328	0.0063, 0.225	Cartilage matrix loss width at 100% depth, cartilage degeneration score in the central third, total cartilage degeneration score, calcified cartilage damage score, osteophyte size
Vertical impulse	0.097, 0.337	0.0032, 0.210	Cartilage matrix loss width at 100% depth, cartilage degeneration score in the central third, total cartilage degeneration score, calcified cartilage damage score
50% withdrawal threshold	0.247, 0.282	<0.0001, 0.215	Cartilage degeneration score in the medial third, capsular thickness

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EVALUATION OF PAIN SYNDROME, FUNCTIONAL ACTIVITY AND QUALITY OF LIFE IN WOMEN WITH KNEE OSTEOARTHRITIS DEPENDING ON THE STRUCTURAL-FUNCTIONAL PARAMETERS OF BONE

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Aim: To evaluate the features of pain syndrome in knee joints, functional activity and quality of life in patients with knee osteoarthritis (KOA) depending on the structural-functional state of bone.

Materials and methods: We examined 90 postmenopausal women aged 50–79 years with knee osteoarthritis of II-III degree, divided into three age groups: the 50–59, 60–69 and 70–79 years old. The diagnosis of knee osteoarthritis was performed according to the criteria of ACR (1995), the stage – by Kellgren–Lawrence classification. The parameters of pain syndrome in knee joints and functional activity were assessed by visual analogue scale, index Lequesne, static balancing and 15-meter test; the quality of life was determined by Euro- Qol-5D. Bone mineral density was measured by Dual-energy X-ray absorptiometry («Prodigy», GE Medical systems, Lunar, model 8743, 2005). To analyze the performance it has been allocated the following groups : 1 – patients with osteoporosis and 2 – with normal bone parameters.

Results: In patients with osteoporosis in the age group 60–69 it was found significantly higher levels of pain in the knee joints and lower parameters of functional activity compared with women with normal bone tissue. Thus, the baseline values of pain were 4.1 ± 0.8 and 2.5 ± 0.2 points accordingly ($F = 5.83$, $p = 0.02$), pain during long-term walking – 3.2 ± 1.2 and 2.3 ± 0.2 points ($F = 5.75$, $p = 0.018$), pain during upstairs walking – 5.9 ± 1.1 and 3.7 ± 0.3 points ($F = 5.23$, $p = 0.024$), Lequesne index – 13.9 ± 1.4 and 11.2 ± 0.4 points respectively ($F = 3.07$, $p = 0.05$). Similar data we didn't find in the age groups 50–59 and 70–79. All age groups with patients with KOA didn't significantly differ in data of static balancing, 15-meter test and quality of life depending on the status of bone tissue.

Conclusions: Structural-functional state of bone in women aged 60–69 years with KOA of II–III degree significantly affect the data of pain syndrome and functional activity. Intensified pain syndrome and limitation of functional activity in patients with knee osteoarthritis and osteoporosis should be considered during treatment.